

1       1. In a database management system that includes a database engine that  
2 accesses and updates objects in a database, the database engine receiving high-level  
3 document commands, each high-level document command for performing an operation on  
4 a document that is associated with a plurality of tables in the database, a method for  
5 reliably notifying client applications of the implementation of particular high-level  
6 document commands in the database, the notification surviving even system failures, the  
7 method comprising the following:

8                  an act of implementing a high-level document command in the database;  
9                  an act of altering a persistently stored notification table to reflect the  
10 implementation of the high-level document command in the database;  
11                  an act of identifying one or more client applications that are to be notified  
12 of the implementation of the high-level document command;  
13                  an act of dispatching a notification of the implementation to the one or more  
14 identified client applications;  
15                  an act of receiving acknowledgement from the one or more client  
16 applications that the notification has been received; and  
17                  in response to receiving acknowledgement, an act of altering the  
18 notification table to reflect that the client application no longer needs to be notified  
19 of the implementation of the high-level document command in the database.

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21       2. The method in accordance with Claim 1, wherein the notification table is  
22 stored in the database.  
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1           3. The method in accordance with Claim 1, wherein the act of dispatching a  
2 notification of the implementation to the one or more identified client applications  
3 comprises an act of transmitting a message to a machine that hosts the client application,  
4 the machine that host the client application being different than the machine that hosts the  
5 database management system.

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7           4. The method in accordance with Claim 1, wherein the act of dispatching a  
8 notification of the implementation to the one or more identified client applications  
9 comprises an act of passing the notification through a function call to the identified client  
10 application, the client application hosted by the same machine as at least the portion of the  
11 database management system responsible for performing the act of dispatching the  
12 notification.

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14           5. The method in accordance with Claim 1, wherein the act of implementing a  
15 high-level document command in the database and the act of altering a persistently stored  
16 notification table to reflect the implementation of the high-level document command in the  
17 database are atomically performed, the acts of implementing and altering either both  
18 occurring or both not occurring at all.

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20           6. The method in accordance with Claim 1, wherein the act of implementing a  
21 high-level document command in the database and the act of altering a persistently stored  
22 notification table to reflect the implementation occur in the same transaction of a database  
23 engine.

1           7. The method in accordance with Claim 1, wherein the document comprises  
2 an electronic mail message.

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4           8. The method in accordance with Claim 1, wherein the document comprises a  
5 folder.

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7           9. The method in accordance with Claim 1, wherein the act of implementing  
8 the high-level document command in the database comprises an act of moving the  
9 document.

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11          10. The method in accordance with Claim 1, wherein the act of implementing  
12 the high-level document command in the database comprises an act of deleting the  
13 document.

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15          11. The method in accordance with Claim 1, wherein the act of implementing  
16 the high-level document command in the database comprises an act of copying the  
17 document.

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19          12. The method in accordance with Claim 1, wherein the act of implementing  
20 the high-level document command in the database comprises an act of adding the  
21 document.

1           13. The method in accordance with Claim 1, wherein the act of implementing  
2 the high-level document command in the database comprises an act of updating the  
3 document.

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5           14. The method in accordance with Claim 1, wherein the received  
6 acknowledgement indicates that the client application has received the notification.

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8           15. The method in accordance with Claim 1, wherein the received  
9 acknowledgement indicates that the client application has implemented processes in  
10 response to the notification.

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1           16. In a database management system that includes a database engine that  
2 accesses and updates objects in a database, the database engine receiving high-level  
3 document commands, each high-level document command for performing an operation on  
4 a document that is associated with a plurality of tables in the database, a method for  
5 reliably notifying client applications of the implementation of particular high-level  
6 document commands in the database, the notification surviving even system failures, the  
7 method comprising the following:

8                 an act of implementing a high-level document command in the database;

9                 and

10                 a step for ensuring a corresponding notification about the high-level  
11 document command is preserved until all of the client applications to be notified  
12 acknowledge at least receipt of the notification.

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14           17. The method in accordance with Claim 16, wherein the step for ensuring a  
15 corresponding notification about the high-level document command is preserved comprises  
16 the following:

17                 an act of altering a persistently stored notification table to reflect the  
18 implementation of the high-level document command in the database;

19                 an act of identifying one or more client applications that are to be notified  
20 of the implementation of the high-level document command;

21                 an act of dispatching a notification of the implementation to the one or more  
22 identified client applications;

23                 an act of receiving acknowledgement from the one or more client  
24 applications that the notification has been received; and

1                   in response to receiving acknowledgement, an act of altering the  
2 notification table to reflect that the client application no longer needs to be notified  
3 of the implementation of the high-level document command in the database.

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5                 18. The method in accordance with Claim 16, wherein the notification table is  
6 stored in the database.

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1           19. A computer program product for use in a database management system that  
2 includes a database engine that accesses and updates objects in a database, the database  
3 engine receiving high-level document commands, each high-level document command for  
4 performing an operation on a document that is associated with a plurality of tables in the  
5 database, the computer-program product for implementing a method for reliably notifying  
6 client applications of the implementation of particular high-level document commands in  
7 the database, the notification surviving even system failures, the computer program  
8 product including a computer-readable medium having stored thereon computer-executable  
9 instructions for performing the following:

10                 an act of causing a high-level document command to be implemented in the  
11 database;

12                 an act of causing a persistently stored notification table to be altered to  
13 reflect the implementation of the high-level document command in the database;

14                 an act of identifying one or more client applications that are to be notified  
15 of the implementation of the high-level document command;

16                 an act of causing a notification of the implementation to be dispatched to  
17 the one or more identified client applications;

18                 an act of detecting receipt of acknowledgement from the one or more client  
19 applications that the notification has been received; and

20                 in response to receiving acknowledgement, an act of causing the  
21 notification table to be altered reflect that the client application no longer needs to  
22 be notified of the implementation of the high-level document command in the  
23 database.

1           20. The computer program product in accordance with Claim 19, wherein the  
2 computer-executable instructions for performing the act of causing a notification of the  
3 implementation to be dispatched to the one or more identified client applications comprise  
4 computer-executable instruction for performing an act of causing a message to be  
5 transmitted to a machine that hosts the client application, the machine that hosts the client  
6 application being different than the machine that hosts the database management system.

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8           21. The computer program product in accordance with Claim 19, wherein the  
9 computer-executable instructions for performing the act of causing a notification of the  
10 implementation to be dispatched to the one or more identified client applications comprises  
11 computer-executable instructions for performing an act of causing the notification to be  
12 passed through a function call to the identified client application, the client application  
13 hosted by the same machine as at least the portion of the database management system  
14 responsible for performing the act of dispatching the notification.

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16          22. The computer program product in accordance with Claim 19, wherein the  
17 computer-executable instructions for performing the act of implementing a high-level  
18 document command in the database and the computer-executable instructions for  
19 performing the act of altering a persistently stored notification table to reflect the  
20 implementation of the high-level document command in the database are configured to  
21 atomically performing the acts of implementing and the act of altering.

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23          23. The computer program product in accordance with Claim 19, wherein the  
24 document comprises an electronic mail message.

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2 24. The computer program product in accordance with Claim 19, wherein the  
3 document comprises a folder.

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5 25. The computer program product in accordance with Claim 19, wherein the  
6 computer-executable instructions for performing the act of causing the high-level  
7 document command to be implemented in the database comprises comprise computer-  
8 executable instructions for performing an act of moving the document.

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10 26. The computer program product in accordance with Claim 19, wherein the  
11 computer-executable instructions for performing the act of causing the high-level  
12 document command to be implemented in the database comprises comprise computer-  
13 executable instructions for performing an act of deleting the document.

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15 27. The computer program product in accordance with Claim 19, wherein the  
16 computer-executable instructions for performing the act of causing the high-level  
17 document command to be implemented in the database comprises comprise computer-  
18 executable instructions for performing an act of copying the document.

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20 28. The computer program product in accordance with Claim 19, wherein the  
21 computer-executable instructions for performing the act of causing the high-level  
22 document command to be implemented in the database comprises comprise computer-  
23 executable instructions for performing an act of adding the document.

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1           29. The computer program product in accordance with Claim 19, wherein the  
2 computer-executable instructions for performing the act of causing the high-level  
3 document command to be implemented in the database comprise computer-executable  
4 instructions for performing an act of updating the document.

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1           30. In a database management system that includes a database engine that  
2 accesses and updates tables in a database, the database engine receiving high-level  
3 document commands, each high-level document command for performing an operation on  
4 a document that is associated with a plurality of tables in the database, a method for  
5 recovering from a database management system failure while allowing notifications that  
6 were to be sent but for the failure to be sent to one or more client applications upon  
7 restarting the database management system, the method comprising the following:

8                 an act of examining a notification table upon restarting the database  
9 management system, the notification table identifying implemented high-level  
10 document commands for which one or more client applications should be notified;

11                 based on the examination of the notification table, an act of identifying a  
12 notification that should have been sent to the one or more client applications, but  
13 for which acknowledgement has not been received from the one or more client  
14 applications; and

15                 an act of dispatching the notification of the implementation to the one or  
16 more identified client applications.

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18           31. The method in accordance with Claim 30, further comprising the following:

19                 an act of receiving acknowledgement from the one or more client  
20 applications that the notification has been received; and

21                 in response to receiving acknowledgement, an act of altering the  
22 notification table to reflect that the client application no longer needs to be notified  
23 of the implementation of the high-level document command in the database.